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APPLIED MATHEMATICS 10b–20b

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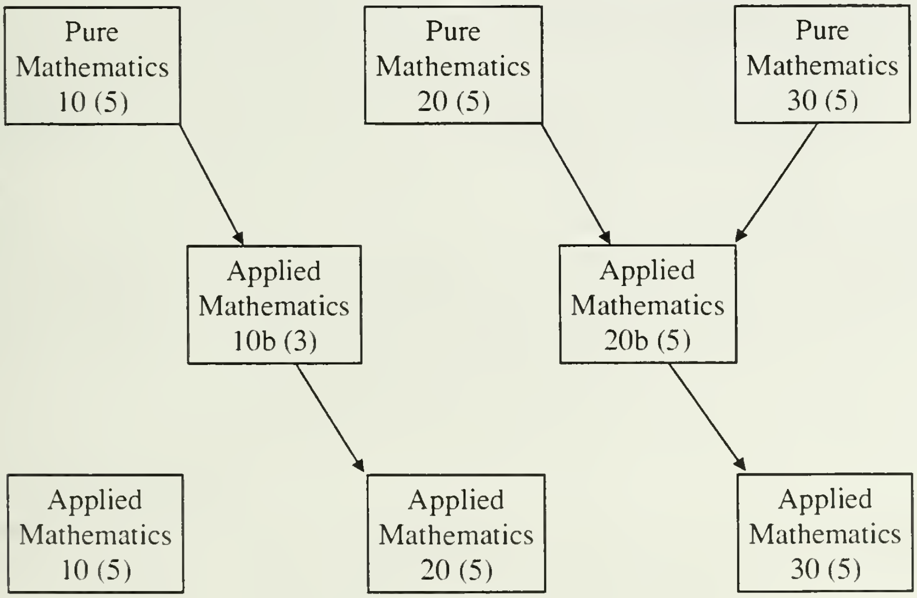
APPLIED MATHEMATICS 10b–20b

A. RATIONALE AND PHILOSOPHY

Students, for a variety of reasons, may want to transfer from the pure mathematics course sequence to the applied mathematics course sequence. In this case, students must satisfy the prerequisites that cover the outcomes exclusive to applied mathematics. The outcomes common to pure mathematics and applied mathematics need not be repeated. For those students who want to transfer after meeting the acceptable standard in Pure Mathematics 10, the prerequisite is Applied Mathematics 10b, a 3-credit course. For those students who want to transfer after meeting the acceptable standard in Pure Mathematics 20 or Pure Mathematics 30, the prerequisite is Applied Mathematics 20b, a 5-credit course. The two bridging courses are shown in the diagram below.


Pure Mathematics 10 (5)
Pure Mathematics 20 (5)
Pure Mathematics 30 (5)
Applied Mathematics 10b (3)
Applied Mathematics 20b (5)
Applied Mathematics 10 (5)
Applied Mathematics 20 (5)
Applied Mathematics 30 (5)

B. LEARNER OUTCOMES

The general outcomes for the Applied Mathematics 10b–20b program are shown first. For each of the two courses, the learner outcomes follow the format of general outcome, specific outcomes and illustrative examples. The illustrative examples are for discretionary use only. The outcomes are arranged in order of strand and substrand, following the order—Number, Patterns and Relations, Shape and Space, Statistics and Probability—established in the Grade 10 to Grade 12 common curriculum framework. This listing is not intended as a sequence for instruction, and the number of outcomes is not an indication of the relative times to be spent on each of the strands. All the specific outcomes have an **A** prefix, such as A1–3, and they refer to those outcomes that are exclusive to applied mathematics.

The learner outcomes listing for Applied Mathematics 10b includes all those outcomes that are exclusive to Applied Mathematics 10.

The learner outcomes listing for Applied Mathematics 20b includes all those outcomes that are exclusive to Applied Mathematics 10 and Applied Mathematics 20.

Outcomes that are exclusive to Applied Mathematics 10 are printed twice, once as Applied Mathematics 10b and once as part of Applied Mathematics 20b.

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GENERAL OUTCOMES—Number Strand

Substrand	Applied Mathematics 10b–20b
Number Operations *Students will:* • demonstrate an understanding of and proficiency with calculations • decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.	Describe and apply arithmetic operations on tables to solve problems, using technology as required. [Applied Mathematics 10b and 20b]

GENERAL OUTCOMES—Patterns and Relations Strand

Substrand	Applied Mathematics 10b–20b
Variables and Equations *Students will:* • represent algebraic expressions in multiple ways.	Use linear programming to solve optimization problems. [Applied Mathematics 20b]

GENERAL OUTCOMES—Shape and Space Strand

Substrand	Applied Mathematics 10b–20b
Measurement *Students will:* • describe and compare everyday phenomena, using either direct or indirect measurement.	Use measuring devices to make estimates and to perform calculations in solving problems. [Applied Mathematics 10b and 20b] Demonstrate an understanding of scale factors, and their interrelationship with the dimensions of similar shapes and objects. [Applied Mathematics 20b]
3-D Objects and 2-D Shapes *Students will:* • describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.	Develop and apply the geometric properties of circles and polygons to solve problems. [Applied Mathematics 20b]

GENERAL OUTCOMES—Statistics and Probability Strand

Substrand	Applied Mathematics 10b–20b
Data Analysis *Students will:* • collect, display and analyze data to make predictions about a population.	Apply line-fitting and correlation techniques to analyze experimental results. [Applied Mathematics 10b and 20b] Analyze graphs or charts of given situations to derive specific information. [Applied Mathematics 20b]

Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes

General Outcome

Describe and apply arithmetic operations on tables to solve problems, using technology as required.

Specific Outcomes

A2–1. Solve problems involving combinations of tables, using:
- addition or subtraction of two tables
- multiplication of a table by a real number
- spreadsheet functions and templates.

[PS, T, V]

Illustrative Examples [Discretionary]

1.1 The following is an income and expenses report for a business for the year ending December 31.

	Year 1	Year 2	Year 3	Year 4	Year 5
Sales					
Laundry	$135 000	$148 000	$150 000	$148 000	$140 000
Dry Cleaning	45 000	47 000	48 000	45 000	45 000
Repairs and Sundry	10 000	11 000	11 000	10 000	9 000
Total Sales	$190 000	$206 000	$209 000	$203 000	$194 000
Operating Expenses					
Salaries and Wages	$ 94 000	$ 99 000	$101 000	$101 000	$ 96 000
Operating Supplies	22 000	24 000	25 000	24 000	23 000
Repairs and Misc.	4 000	5 000	6 000	8 000	5 000
Accounting and Legal	2 000	2 000	2 000	2 000	2 000
Advertising	2 000	2 000	2 000	2 000	2 000
Sundry	4 000	5 000	5 000	4 500	4 000
Total Operating Expenses	$128 000	$137 000	$141 000	$141 500	$132 000
Profit Before Overhead	$ 62 000	$ 69 000	$ 68 000	$ 61 500	$ 62 000
Overhead Expenses					
Rent	$ 12 000	$ 14 000	$ 16 000	$ 18 000	$ 18 000
Utilities	6 000	7 000	8 000	9 000	10 000
Insurance	3 000	3 000	3 000	3 000	3 000
Taxes and Licenses	3 000	3 000	4 000	4 000	5 000
Depreciation – Equip.	10 000	8 000	7 000	6 000	5 000
Total Overhead Exp.	$ 34 000	$ 35 000	$ 38 000	$ 40 000	$ 41 000
Profit Before Tax	$ 28 000	$ 34 000	$ 30 000	$ 21 500	$ 21 000
Income Tax	$ 7 000	$ 8 500	$ 7 500	$ 5 375	$ 5 250
Net Profit	$ 21 000	$ 25 500	$ 22 500	$ 16 125	$ 15 750

Enter the data above onto a spreadsheet template provided to students.

1.1.1 a) Calculate the dollar change in total sales, total operating expenses and total overhead expenses, between each year in the table.

b) Which is the greatest dollar change?

Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	1.1.2 a) Calculate the percentage change in total sales, total operating expenses and total overhead expenses, between each year in the table. b) Which is the greatest percentage change? 1.1.3 a) Determine the percentage change for each item for each year. b) Predict the figures for each type of income and expense for year 6, and predict the net profit for year 6. 1.1.4 Prepare a line graph showing the annual sales, operating expenses and overhead expenses for the five year period. Use the graph to determine which item has the greatest rate of increase, and which item has the greatest rate of decrease. 1.1.5 For the five year period, use a line of best fit procedure to determine equations of lines of best fit for total sales, total operating expenses and total overhead expenses. Use these equations to predict the values in year 6. From these values, predict the net profit in year 6. 1.1.6 Calculate the net profit as a percentage of sales for each of the five years. In which year did the net profit represent the highest proportion of sales? 1.1.7 Derive a formula relating total sales, total operating expenses, total overhead expenses, income tax and net profit.

Strand: Number (Number Operations)
Students will:

- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General and Specific Outcomes

Illustrative Examples [Discretionary]

1.2 A banker needs to provide clients with information on foreign exchange. Use the foreign exchange chart provided, or a current chart from a newspaper, to answer the following questions.
   a) Calculate the cost in Canadian dollars of a refrigerator that costs $850 US.
   b) Calculate the cost in US dollars of an outboard motor selling in Canada for $1200.
   c) Hans receives a cheque for 100 Swiss francs from his uncle in Berne. How many Dutch guilders would he get for this cheque? How many Canadian dollars?
   d) Elsa is going on a holiday to Venezuela. She is told that she will have to pay $3.48 US for every 100 bolivars. How many bolivars will she get for $500 Canadian?

February 1, 1996

Foreign Exchange
Cross Rates

	Canadian dollar	US dollar	British pound	German mark	Japanese yen
Canada dollar	–	1.3743	2.0762	0.9227	0.012850
US dollar	0.7276	–	1.5107	0.6714	0.009350
British pound	0.4816	0.6619	–	0.4444	0.006189
German mark	1.0838	1.4894	2.2501	–	0.013927
Japanese yen	77.82	106.95	161.57	71.81	–
Swiss franc	0.8821	1.2122	1.8313	0.8139	0.011335
French franc	3.7230	5.1165	7.7297	3.4352	0.047841
Dutch guilder	1.2134	1.6676	2.5194	1.1196	0.015593
Italian lira	1156.07	1588.79	2400.23	1066.71	14.855491

Foreign Exchange
Cross Rates

	Swiss franc	French franc	Dutch guilder	Italian lira
Canada dollar	1.1337	0.2686	0.8241	0.000865
US dollar	0.8249	0.1954	0.5997	0.000629
British pound	0.5460	0.1294	0.3969	0.000417
German mark	1.2287	0.2911	0.8931	0.000937
Japanese yen	88.23	20.90	64.13	0.067315
Swiss franc	–	0.2369	0.7269	0.000763
French franc	4.2208	–	3.0681	0.003220
Dutch guilder	1.3757	0.3259	–	0.001050
Italian lira	1310.64	310.52	952.72	–

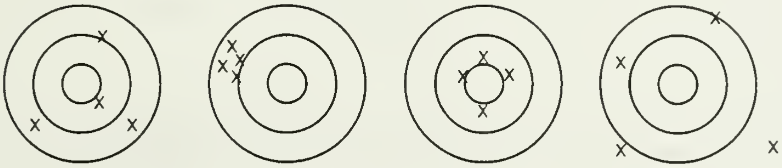
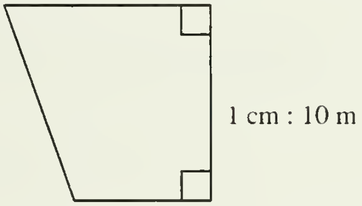
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Use measuring devices to make estimates and to perform calculations in solving problems. **Specific Outcomes**	
A1–1. Select and apply appropriate instruments, units of measure (in SI and Imperial systems) and measurement strategies to find lengths, areas and volumes. [E, PS, T]	1.1 Find a rule that relates hectares to acres. Is there a rule of thumb that can be used for estimates? Estimate the area of a plot of land shown in a plan, using both units of measurement. 1.2 Use a micrometer to measure the thickness of 10 sheets of paper. Use the results of this measurement to determine the thickness of one sheet of paper. 1.3 Use a micrometer to measure the thickness of a human hair. 1.4 Calculate the area of a flat rectangular surface measuring 21 m by 14 m. Give the answer in cm^2, m^2 and dm^2. 1.5 Estimate the volume of a water bed bladder having a depth of 300 mm, a width of 1.8 m and a length of 210 cm. 1.6 Given a cylindrical pipe of known length, choose appropriate measuring devices to find the internal and external diameters of the pipe. Find the volume of metal in the pipe. Explain your measurement and calculation procedures. 1.7 Measure the internal dimensions of a rectangular container, and calculate its volume in cm^3. Find its volume, in litres or in millilitres, using a calibrated cylinder. 1.8 Use a vernier calliper to measure the inside diameter of a piece of PVC pipe. 1.9 Measure the angle between two faces of a pyramid to the nearest degree. 1.10 Measure the angle of a bevel to the nearest tenth of a degree, using a vernier bevel protractor.

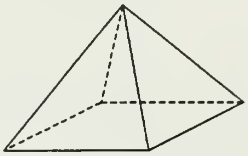
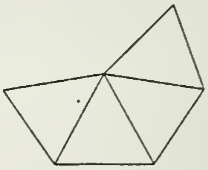
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
A1–2. Analyze the limitations of measuring instruments and measurement strategies, using the concepts of precision and accuracy. [C, R]	2.1 Which ruler is most precise? a) a ruler divided into tenths of an inch b) a ruler divided into eighths of an inch c) a ruler divided into millimetres. 2.2 Of the four diagrams revealing shots on a target, which best represents accuracy and precision? 
A1–3. Solve problems involving length, area, volume, time, mass and rates derived from these. [C, E, PS]	3.1 A room is 16 feet long, 12 feet wide and 8 feet high. The walls and ceiling are to be painted. There are two doors in the room, each 6 feet 6 inches high and 30 inches wide. There are two windows, each 2 feet by 4 feet. Information on the paint can states that you should allow 3.79 L for every 38 m^2 of smooth surface. Two coats of paint are needed. How many cans of paint are needed, if each can contains 3.79 L? If the painter is able to paint 3 m^2 in 10 minutes, how long will it take to paint the room? 3.2 A person buys a property that is irregularly shaped. See scale drawing below.  What is the total area, in m^2, of the lot? 3.3 A car has a highway fuel consumption of 34 miles per Imperial gallon. What is this in litres per 100 kilometres? Explain the conversion strategy used.

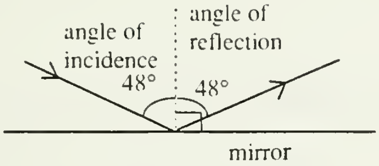
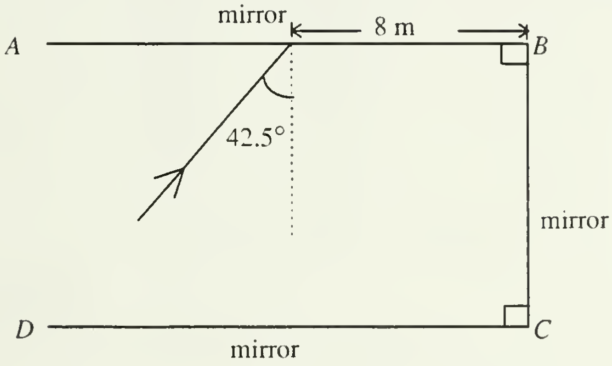
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	3.4 A sheet metal worker must fabricate a pyramidal cap for a square column. The base of the cap is 1.5 m by 1.5 m and the height is 5 m. Determine the area of material required.   3.5 A building contractor is to provide wheel chair access to a new building. A space of 10 m by 10 m is available, on the west side of the entrance stairs, for a ramp. Municipal building codes specify that wheel chair ramps must have a minimum width of 1.5 m and a maximum slope of 10°. The vertical rise needed is 2 m. Construction costs for ramps of this kind average $300 per linear metre. a) Design a ramp to meet the above specifications. b) Make a plan or drawing of the proposed ramp showing the measurements, including the slopes, of the various parts. c) Give an estimate of the cost of construction.

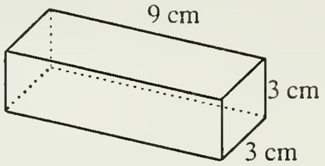
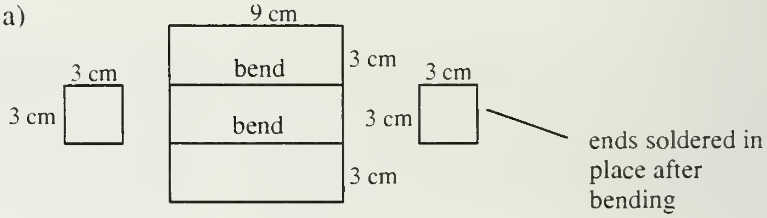
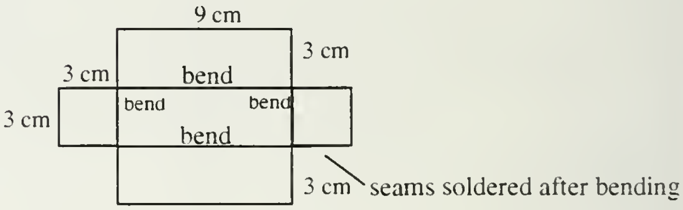
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
A1–4. Interpret drawings, and use the information to solve problems. [C, PS, V]	4.1 The law of reflection states that when a ray of light is reflected at a surface, the angle of reflection is equal to the angle of incidence. Therefore, if light hits a mirror at an angle of incidence of 48°, the angle of reflection will also be 48°.  angle of incidence 48° angle of reflection 48° mirror The following diagram of the interior of a hall of mirrors shows a ray of light hitting mirror *AB* at a point 8 m from *B* and at an angle of incidence of 42.5°. Using the law of reflection, and either trigonometric relationships or scale drawings, find the angle of reflection from mirror *CD* and the distance from *C* at which the ray will hit mirror *CD*, if mirror *BC* is 12 m long.  mirror 8 m A B 42.5° mirror D C mirror

Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	4.2 A silver box, with dimensions as outlined below, is made from sheet metal.  Two methods of construction are shown. a)  9 cm 3 cm 3 cm bend bend 3 cm 3 cm 3 cm 3 cm 3 cm ends soldered in place after bending b)  9 cm 3 cm 3 cm 3 cm bend bend bend bend 3 cm seams soldered after bending The material cost is $2.50/cm^2, and soldering costs $0.70/cm. For each method of construction, calculate the cost for the box.

Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes

General Outcome

Apply line-fitting and correlation techniques to analyze experimental results.

Specific Outcomes

A2–2. Determine the equation of a line of best fit, using:
- estimate of slope and one point
- median–median method
- least squares method with technology.

[CN, PS, T, V]

Illustrative Examples [Discretionary]

2.1 Below are the heights, in metres, and masses, in kilograms, of 13 students.

Student	Height (m)	Mass(kg)
a	1.50	51
b	1.51	56
c	1.52	54
d	1.54	58
e	1.56	56
f	1.58	62
g	1.60	91
h	1.61	65
i	1.64	66
j	1.65	70
k	1.66	71
l	1.70	74
m	1.72	74

Plot the data and determine lines of best fit, using:
a) estimation
b) median–median method
c) least squares method and a computing tool.

Calculate the slope and intercept of each of the lines, and compare the results.

Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes | **Illustrative Examples [Discretionary]**

2.2

Oil changes per year	3	5	2	3	1	4	6	4	3	2	0	10	7
Cost of repairs	$300	300	500	400	700	400	100	250	450	650	600	0	150

a) Use graphing technology to prepare a scatterplot. Draw a line of best fit.
b) From the line of best fit, make predictions of the repair cost with eight oil changes and with 14 oil changes.
c) How reliable are these predictions?
d) Beyond what point are the predictions unreliable?

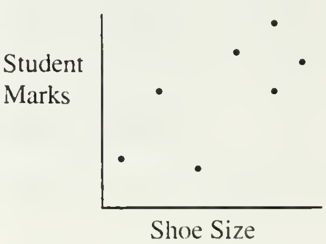
Excerpted and adapted with permission from *Data Analysis and Statistics* (*Curriculum and Evaluation* Addenda Series, Grades 9–12), copyright 1992 by the National Council of Teachers of Mathematics. All rights reserved.

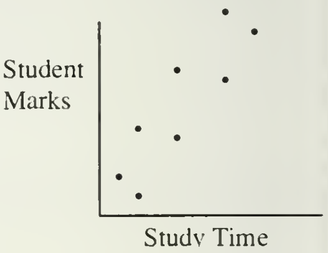
A2–3. Use technological devices to determine the correlation coefficient r. [T]

3.1 Measure the height of each person in a class and the distance, from fingertip to fingertip, of their outstretched arms.
a) Record this data as a set of ordered pairs, with height as the first element and fingertip to fingertip distance as the second.
b) Plot the data on a coordinate system.
c) By examining the data, predict a value for the correlation coefficient r.
d) Using a calculating tool, determine the correlation coefficient r for this data.

A2–4. Interpret the correlation coefficient r and its limitations for varying problem situations, using relevant scatterplots. [C, R, V]

4.1 What do the following scatterplots and corresponding r-values represent?


Scatterplot (1)


Scatterplot (2)

Scatterplot (1) is the plot of student marks on their last test against their shoe size. The value for r was calculated to be 0.2. Scatterplot (2) is the plot of student marks on their last test against the time spent studying. The value for r was calculated to be 0.8. Describe the relationship between the values of r and the shape of the scatterplots.

Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes

General Outcome

Describe and apply arithmetic operations on tables to solve problems, using technology as required.

Specific Outcomes

A2–1. Solve problems involving combinations of tables, using:
- addition or subtraction of two tables
- multiplication of a table by a real number
- spreadsheet functions and templates.

[PS, T, V]

Illustrative Examples [Discretionary]

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Overhead Expenses					
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Utilities	6 000	7 000	8 000	9 000	10 000
Insurance	3 000	3 000	3 000	3 000	3 000
Taxes and Licenses	3 000	3 000	4 000	4 000	5 000
Depreciation – Equip.	10 000	8 000	7 000	6 000	5 000
Total Overhead Exp.	$ 34 000	$ 35 000	$ 38 000	$ 40 000	$ 41 000
Profit Before Tax	$ 28 000	$ 34 000	$ 30 000	$ 21 500	$ 21 000
Income Tax	$ 7 000	$ 8 500	$ 7 500	$ 5 375	$ 5 250
Net Profit	$ 21 000	$ 25 500	$ 22 500	$ 16 125	$ 15 750

Enter the data above onto a spreadsheet template provided to students.

1.1.1 a) Calculate the dollar change in total sales, total operating expenses and total overhead expenses, between each year in the table.

b) Which is the greatest dollar change?

Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	1.1.2 a) Calculate the percentage change in total sales, total operating expenses and total overhead expenses, between each year in the table. b) Which is the greatest percentage change? 1.1.3 a) Determine the percentage change for each item for each year. b) Predict the figures for each type of income and expense for year 6, and predict the net profit for year 6. 1.1.4 Prepare a line graph showing the annual sales, operating expenses and overhead expenses for the five year period. Use the graph to determine which item has the greatest rate of increase, and which item has the greatest rate of decrease. 1.1.5 For the five year period, use a line of best fit procedure to determine equations of lines of best fit for total sales, total operating expenses and total overhead expenses. Use these equations to predict the values in year 6. From these values, predict the net profit in year 6. 1.1.6 Calculate the net profit as a percentage of sales for each of the five years. In which year did the net profit represent the highest proportion of sales? 1.1.7 Derive a formula relating total sales, total operating expenses, total overhead expenses, income tax and net profit.

Strand: Number (Number Operations)
Students will:
- demonstrate an understanding of and proficiency with calculations
- decide which arithmetic operation or operations can be used to solve a problem and then solve the problem.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]

1.2 A banker needs to provide clients with information on foreign exchange. Use the foreign exchange chart provided, or a current chart from a newspaper, to answer the following questions.
   a) Calculate the cost in Canadian dollars of a refrigerator that costs $850 US.
   b) Calculate the cost in US dollars of an outboard motor selling in Canada for $1200.
   c) Hans receives a cheque for 100 Swiss francs from his uncle in Berne. How many Dutch guilders would he get for this cheque? How many Canadian dollars?
   d) Elsa is going on a holiday to Venezuela. She is told that she will have to pay $3.48 US for every 100 bolivars. How many bolivars will she get for $500 Canadian?

February 1, 1996

Foreign Exchange

Cross Rates

	Canadian dollar	US dollar	British pound	German mark	Japanese yen
Canada dollar	–	1.3743	2.0762	0.9227	0.012850
US dollar	0.7276	–	1.5107	0.6714	0.009350
British pound	0.4816	0.6619	–	0.4444	0.006189
German mark	1.0838	1.4894	2.2501	–	0.013927
Japanese yen	77.82	106.95	161.57	71.81	–
Swiss franc	0.8821	1.2122	1.8313	0.8139	0.011335
French franc	3.7230	5.1165	7.7297	3.4352	0.047841
Dutch guilder	1.2134	1.6676	2.5194	1.1196	0.015593
Italian lira	1156.07	1588.79	2400.23	1066.71	14.855491

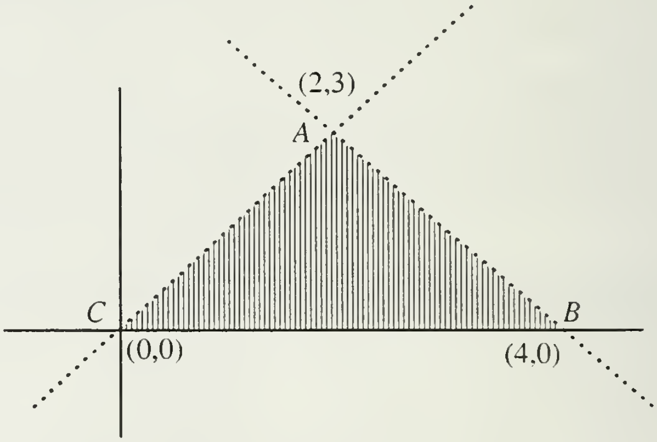
Foreign Exchange

Cross Rates

	Swiss franc	French franc	Dutch guilder	Italian lira
Canada dollar	1.1337	0.2686	0.8241	0.000865
US dollar	0.8249	0.1954	0.5997	0.000629
British pound	0.5460	0.1294	0.3969	0.000417
German mark	1.2287	0.2911	0.8931	0.000937
Japanese yen	88.23	20.90	64.13	0.067315
Swiss franc	–	0.2369	0.7269	0.000763
French franc	4.2208	–	3.0681	0.003220
Dutch guilder	1.3757	0.3259	–	0.001050
Italian lira	1310.64	310.52	952.72	–

Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Use linear programming to solve optimization problems. **Specific Outcomes**	
A5–1. Solve, graphically, systems of linear inequalities, in two variables, using technology. [CN, PS, T, V]	1.1 Graph the solution to the following system of inequalities: $3x - y > 4$ $2x + y \le 6$. 1.2 Given the following diagram, provide the system of inequalities whose solution is the interior of ΔABC. 
A5–2. Design and solve linear and nonlinear systems, in two variables, to model problem situations. [C, CN, PS, R, V]	2.1 A farmer has chickens and turkeys. He has fewer than 100 birds. He sells chickens for $10 each and turkeys for $30 each, and he earns more than $1500. Represent the situation graphically, and shade the region containing possible solutions. 2.2 A desktop publisher has to design formats for rectangular data tables and uses graphing grids as a design tool. Shade the region on the grid that represents the possible dimensions of rectangles in which the length is less than twice the width, the perimeter is at most 48 cm, and the area is at least 32 cm^2.

Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

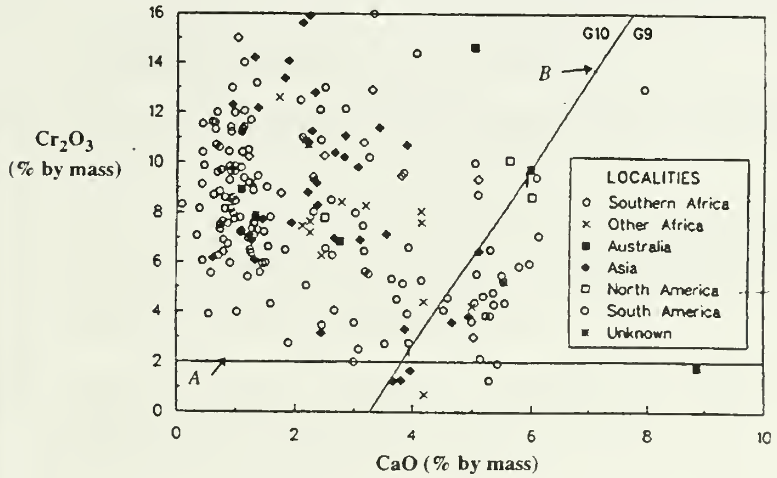
[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes | **Illustrative Examples [Discretionary]**

2.3 Diamond prospecting is done by testing the garnets found in rocks called kimberlites for the per cent content of Cr_2O_3 and CaO. The following graph shows the Cr_2O_3 to CaO ratio for diamond-bearing rocks worldwide. Diamonds occur 85% of the time with garnets classed as G10. This G10 area is defined by the function lines *A* and *B*.

a) Define the system of linear inequalities that determines the G10 area.
b) Which of the following samples would indicate that further prospecting is warranted?

Garnet Sample No.	Garnet mass (g)	Cr_2O_3 mass (g)	CaO mass (g)
1	16.1	1.71	1.35
2	8.7	0.094	0.72
3	4.2	0.35	0.051
4	12.0	1.80	0.61



A5–3. Apply linear programming to find optimal solutions to decision-making problems. [C, PS, R, T, V]

3.1 An agricultural club has a 10 ha plot of land available for a market garden project. It has selected corn and potatoes to plant and has $4000 for the project. The corn will cost $300/ha to grow and will generate $375/ha gross income. The potatoes will cost $500/ha to grow and will generate $650/ha gross income.

a) Construct the function that describes the revenue from the project.
b) Construct the inequalities that describe the restrictions.
c) Plot this system of inequalities.
d) Identify the feasible solutions.
e) Determine the optimal solution.

Strand: Patterns and Relations (Variables and Equations)
Students will:
- represent algebraic expressions in multiple ways.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	**Illustrative Examples [Discretionary]**
	3.2 A manufacturing company originally has three employees. The company directive is to hire additional persons to build widgets. Widgets can only be built by teams of 2 people. Eight teams can produce 500 widgets and 10 teams can produce 600 widgets. It is assumed that a linear relation exists between the number of teams and the number of widgets produced. The plant has the capacity to produce 1000 widgets. The Department of Health limits the total number of employees in the building to 15, due to the air quality problem. Using multimedia techniques and linear programming, write a presentation to the board of directors explaining how to optimize production. 3.3 Find the maximum and minimum values of the quantity C, where $C = 2x - 5y$, given the constraints: $x \geq 0$ $y \geq 0$ $x \leq 12$ $y \leq x + 8$ $x + 2y \leq 28$ $3x + y \leq 39$.

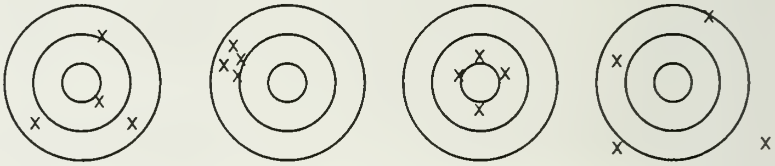
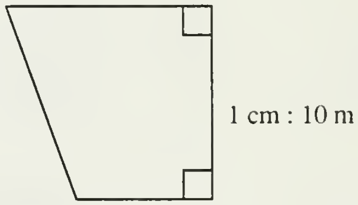
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Use measuring devices to make estimates and to perform calculations in solving problems.	
Specific Outcomes	
A1–1. Select and apply appropriate instruments, units of measure (in SI and Imperial systems) and measurement strategies to find lengths, areas and volumes. [E, PS, T]	1.1 Find a rule that relates hectares to acres. Is there a rule of thumb that can be used for estimates? Estimate the area of a plot of land shown in a plan, using both units of measurement. 1.2 Use a micrometer to measure the thickness of 10 sheets of paper. Use the results of this measurement to determine the thickness of one sheet of paper. 1.3 Use a micrometer to measure the thickness of a human hair. 1.4 Calculate the area of a flat rectangular surface measuring 21 m by 14 m. Give the answer in cm^2, m^2 and dm^2. 1.5 Estimate the volume of a water bed bladder having a depth of 300 mm, a width of 1.8 m and a length of 210 cm. 1.6 Given a cylindrical pipe of known length, choose appropriate measuring devices to find the internal and external diameters of the pipe. Find the volume of metal in the pipe. Explain your measurement and calculation procedures. 1.7 Measure the internal dimensions of a rectangular container, and calculate its volume in cm^3. Find its volume, in litres or in millilitres, using a calibrated cylinder. 1.8 Use a vernier calliper to measure the inside diameter of a piece of PVC pipe. 1.9 Measure the angle between two faces of a pyramid to the nearest degree. 1.10 Measure the angle of a bevel to the nearest tenth of a degree, using a vernier bevel protractor.

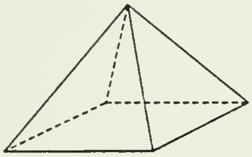
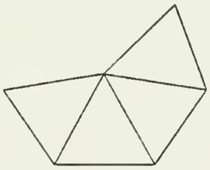
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
A1–2. Analyze the limitations of measuring instruments and measurement strategies, using the concepts of precision and accuracy. [C, R]	2.1 Which ruler is most precise? a) a ruler divided into tenths of an inch b) a ruler divided into eighths of an inch c) a ruler divided into millimetres. 2.2 Of the four diagrams revealing shots on a target, which best represents accuracy and precision? 
A1–3. Solve problems involving length, area, volume, time, mass and rates derived from these. [C, E, PS]	3.1 A room is 16 feet long, 12 feet wide and 8 feet high. The walls and ceiling are to be painted. There are two doors in the room, each 6 feet 6 inches high and 30 inches wide. There are two windows, each 2 feet by 4 feet. Information on the paint can states that you should allow 3.79 L for every 38 m^2 of smooth surface. Two coats of paint are needed. How many cans of paint are needed, if each can contains 3.79 L? If the painter is able to paint 3 m^2 in 10 minutes, how long will it take to paint the room? 3.2 A person buys a property that is irregularly shaped. See scale drawing below.  What is the total area, in m^2, of the lot? 3.3 A car has a highway fuel consumption of 34 miles per Imperial gallon. What is this in litres per 100 kilometres? Explain the conversion strategy used.

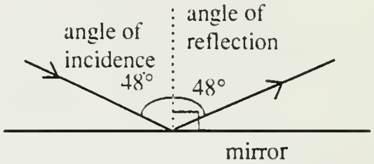
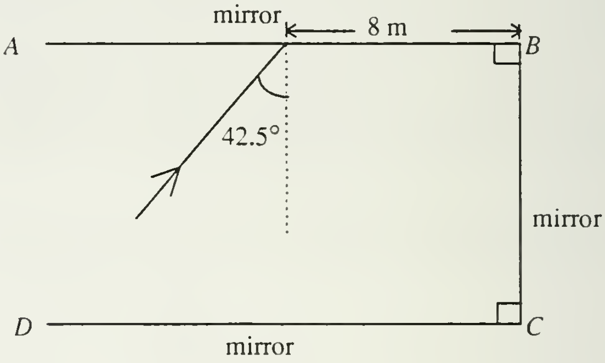
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	**Illustrative Examples [Discretionary]**
	3.4 A sheet metal worker must fabricate a pyramidal cap for a square column. The base of the cap is 1.5 m by 1.5 m and the height is 5 m. Determine the area of material required.   3.5 A building contractor is to provide wheel chair access to a new building. A space of 10 m by 10 m is available, on the west side of the entrance stairs, for a ramp. Municipal building codes specify that wheel chair ramps must have a minimum width of 1.5 m and a maximum slope of 10°. The vertical rise needed is 2 m. Construction costs for ramps of this kind average $300 per linear metre. a) Design a ramp to meet the above specifications. b) Make a plan or drawing of the proposed ramp showing the measurements, including the slopes, of the various parts. c) Give an estimate of the cost of construction.

Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

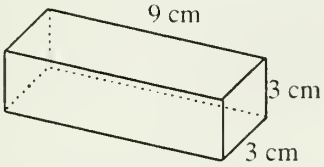
General and Specific Outcomes	Illustrative Examples [Discretionary]
A1–4. Interpret drawings, and use the information to solve problems. [C, PS, V]	4.1 The law of reflection states that when a ray of light is reflected at a surface, the angle of reflection is equal to the angle of incidence. Therefore, if light hits a mirror at an angle of incidence of 48°, the angle of reflection will also be 48°.  angle of incidence 48° angle of reflection 48° mirror The following diagram of the interior of a hall of mirrors shows a ray of light hitting mirror *AB* at a point 8 m from *B* and at an angle of incidence of 42.5°. Using the law of reflection, and either trigonometric relationships or scale drawings, find the angle of reflection from mirror *CD* and the distance from *C* at which the ray will hit mirror *CD*, if mirror *BC* is 12 m long.  A mirror 8 m B 42.5° mirror D mirror C

Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C] Communication
[CN] Connections
[E] Estimation and Mental Mathematics
[PS] Problem Solving
[R] Reasoning
[T] Technology
[V] Visualization

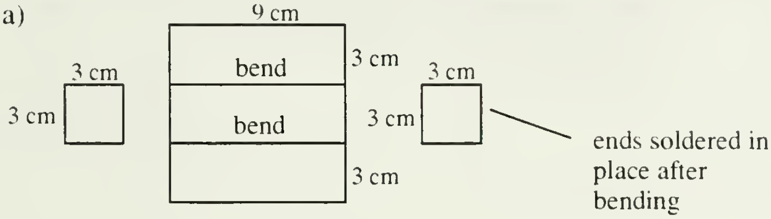
<table>
<tr><th>General and Specific Outcomes</th><th>Illustrative Examples [Discretionary]</th></tr>
<tr><td></td><td>

4.2 A silver box, with dimensions as outlined below, is made from sheet metal.

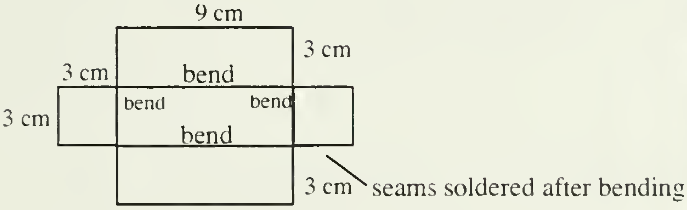


Two methods of construction are shown.

a)



b)

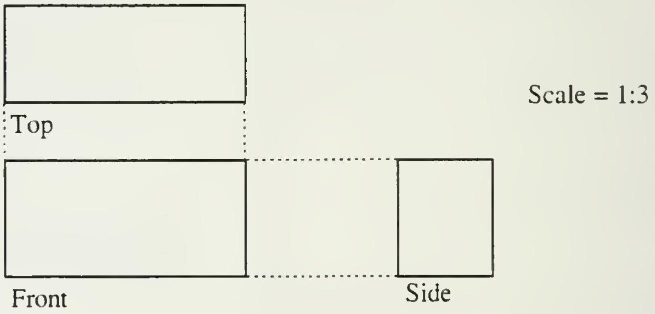
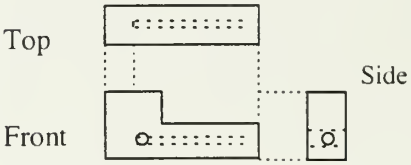


The material cost is $2.50/cm^2, and soldering costs $0.70/cm. For each method of construction, calculate the cost for the box.

</td></tr>
</table>

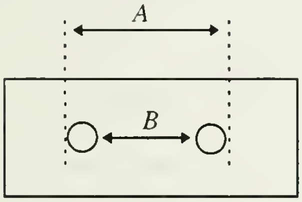
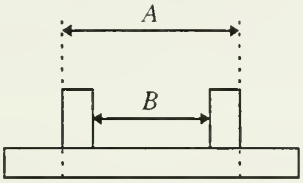
Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Demonstrate an understanding of scale factors, and their interrelationship with the dimensions of similar shapes and objects. **Specific Outcomes**	
A3–1. Enlarge or reduce a dimensioned object, according to a specified scale. [C, CN, PS, V]	1.1 A classroom has dimensions of nine metres by eight metres. Produce a scale drawing of the classroom to a scale of 1:50. 1.2 Using surveyor's chains, tapes or other linear measuring devices, measure a chosen plot of land, and calculate its area. Make a scale drawing, using the same measurement system for the drawing as was used with the measurement instruments. 1.3 From the scale drawing below, construct an actual sized model of the box.  1.4 To better visualize an object, architects often build clay models. Use molding clay to build a model of the object that is shown in the plan below. Scale = 2:3 

Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Use measuring devices to make estimates and to perform calculations in solving problems. **Specific Outcomes**	
A3–2. Calculate maximum and minimum values, using tolerances, for lengths, areas and volumes. [PS, R, V]	2.1 The diagrams represent the top and side views of a drawer handle. If the tolerance specifications are as shown below, determine the maximum and minimum dimensions for the distance between the two centres.  Figure 1: Top View  Figure 2: Side View $A = 10.50 \pm 0.02$ cm $B = 8.20 \pm 0.04$ cm 2.2 To carry a high electric current to an LRT car, a wire must have a cross-sectional area of 45 ± 2 mm^2. What are the maximum and minimum diameters allowed for this wire? 2.3 Steel ball bearings have a diameter of 0.80 ± 0.02 cm. Find the volume of one ball bearing, in cm^3, with the tolerance included. What is the maximum number of such ball bearings that can be made from 1000 cm^3 of steel?
A3–3. Solve problems involving percentage error when input variables are expressed with percentage errors. [PS, R, V]	3.1 A rectangular table was measured to be 420 cm long and 170 cm wide. The length was measured with an error of 1.5% and the width with an error of 2%. Calculate the maximum and minimum possible areas, and estimate the percentage error in the calculated area.

Strand: Shape and Space (Measurement)
Students will:
- describe and compare everyday phenomena, using either direct or indirect measurement.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	3.2 An experiment is done to find the density of a ball bearing. The mass is measured to be 473 g, with a percentage error of 4%. The diameter is measured to be 5.1 cm ± 2%. a) Calculate the density of the ball bearing, showing its percentage error. b) Which is more effective in reducing percentage error: using a new balance that gives a mass of 473 g ± 1.5%, or using a new calliper that gives a diameter of 5.1 cm ± 1%? Justify your answer with appropriate calculations.
A3–4. Design an appropriate measuring process or device to solve a problem. [E, PS, V]	4.1 Design and construct a measuring device; e.g., a planimeter with a horizontal vernier scale and cardboard wheel, graduated accordingly. Apply the constructed instrument to find, according to scale, the areas of large, irregular shapes. 4.2 To calculate the loss of wheat after a hailstorm, a farmer counts the number of broken wheat heads in a small area, calculates the proportion of broken heads in the sample and extrapolates this proportion to the entire field. Explain the process used to gather the data, and explain how the estimate of loss is determined.

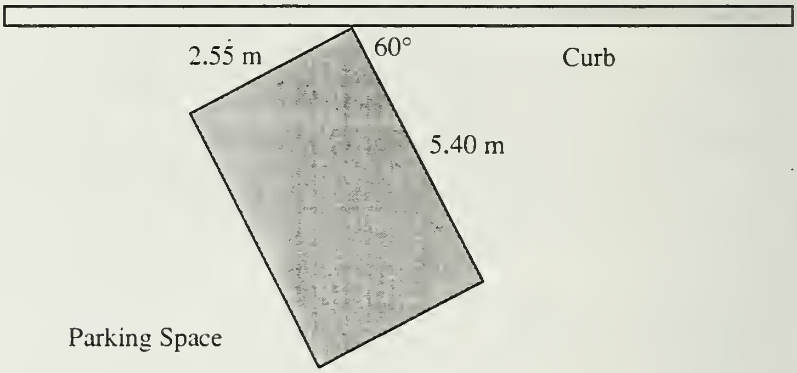
Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Develop and apply the geometric properties of circles and polygons to solve problems. **Specific Outcomes**	
A3–5. Use properties of circles and polygons to solve design and layout problems. [CN, PS, V]	5.1 The pattern on a piece of vinyl flooring consists of a square and four equilateral triangles. Each equilateral triangle has as its base one side of the square. Circles are inscribed in each triangle and in the square. a) Start with a square of side length 6 cm. Draw the design, full size. b) Determine the ratio of the area of the small circle to the area of the large circle. 5.2 A standard sheet of paper is 22 cm by 28 cm. The margins are 3 cm on the left, on the right and at the top. The bottom margin is 4 cm. A project summary consists of one table that is 10 cm by 6 cm, three tables that are 8 cm by 5 cm each and 50 cm^2 of text that can be arranged in any shape(s). a) Prepare a possible layout, assuming that the tables can be oriented with their long sides parallel to any edge of the paper. b) Prepare a possible layout, assuming that the long side of any table must be parallel to the top edge of the paper. c) What is the maximum area of text that can be included with the four tables, if each table must have at least 1 cm margins? 5.3 A school has 325 students, all of whom have pictures to be put in the yearbook. The yearbook pages are 9.5 inches by 12 inches. The inside margins are 1.5 inches, the outside margins are 1 inch, the top margin is 1.2 inches, and the bottom margin is 1.5 inches. Each photograph is 53 mm by 35 mm. The minimum space between sides of pictures is 0.5 inches and between the bottom of one picture and the top of the next is 0.9 inches. a) How many photographs can be put on a single page? b) If the number of pages used must be divisible by 8, design a layout so that all 325 photographs can be included, without having any blank pages.

Strand: Shape and Space (3-D Objects and 2-D Shapes)
Students will:
- describe the characteristics of 3-D objects and 2-D shapes, and analyze the relationships among them.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
	5.4 An average automobile requires an angle parking space with dimensions of 2.55 m wide and 5.40 m long. If spaces are being calculated for parallel parking, each automobile will require an additional length of 1.20 m as manoeuvring room. A small town's main street currently uses 60° angle parking.  The town council has contracted you to provide information for town planning decisions regarding parking capacity. 1. Develop a formula for the number of spaces N for a given curb length L for 60° angle parking. 2. Two years later, increased traffic along the main street makes angle parking unsafe. The town council wants to know how many spaces N they will have for a given curb length L, if they switch to parallel parking. The town's main street is 200 m long. If the town council wants to retain the same parking capacity as before, how many additional spaces will have to be developed away from the main street in order to offset the spaces lost by the switch to parallel parking? 5.5 A cylindrical can is 12 cm high and 6 cm in diameter. The can is closed, top and bottom. It is cut from a rectangular sheet of metal, and then the pieces are sealed together to form the can. a) Determine the smallest rectangle that can be used to make one can. b) What percentage of the metal is wasted in part a)? c) If seams require 2 mm of extra metal per join, what are the new dimensions of the smallest rectangle?

Strand: Statistics and Probability (Data Analysis)
Students will:
- collect, display and analyze data to make predictions about a population.

[C]	Communication	[PS]	Problem Solving
[CN]	Connections	[R]	Reasoning
[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Apply line-fitting and correlation techniques to analyze experimental results. **Specific Outcomes**	
A2–2. Determine the equation of a line of best fit, using: • estimate of slope and one point • median–median method • least squares method with technology. [CN, PS, T, V]	2.1 Below are the heights, in metres, and masses, in kilograms, of 13 students. (see table below) Plot the data and determine lines of best fit, using: a) estimation b) median–median method c) least squares method and a computing tool. Calculate the slope and intercept of each of the lines, and compare the results.

Student	Height (m)	Mass(kg)
a	1.50	51
b	1.51	56
c	1.52	54
d	1.54	58
e	1.56	56
f	1.58	62
g	1.60	91
h	1.61	65
i	1.64	66
j	1.65	70
k	1.66	71
l	1.70	74
m	1.72	74

Strand: Statistics and Probability (Data Analysis)
Students will:
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[C]	Communication	[PS]	Problem Solving
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[E]	Estimation and Mental Mathematics	[T]	Technology
		[V]	Visualization

General and Specific Outcomes | **Illustrative Examples [Discretionary]**

2.2

Oil changes per year	3	5	2	3	1	4	6	4	3	2	0	10	7
Cost of repairs	$300	300	500	400	700	400	100	250	450	650	600	0	150

a) Use graphing technology to prepare a scatterplot. Draw a line of best fit.
b) From the line of best fit, make predictions of the repair cost with eight oil changes and with 14 oil changes.
c) How reliable are these predictions?
d) Beyond what point are the predictions unreliable?

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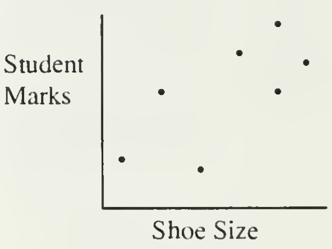
A2–3. Use technological devices to determine the correlation coefficient r. [T]

3.1 Measure the height of each person in a class and the distance, from fingertip to fingertip, of their outstretched arms.
a) Record this data as a set of ordered pairs, with height as the first element and fingertip to fingertip distance as the second.
b) Plot the data on a coordinate system.
c) By examining the data, predict a value for the correlation coefficient r.
d) Using a calculating tool, determine the correlation coefficient r for this data.

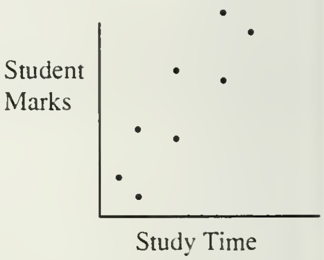
A2–4. Interpret the correlation coefficient r and its limitations for varying problem situations, using relevant scatterplots. [C, R, V]

4.1 What do the following scatterplots and corresponding r-values represent?

Scatterplot (1)



Scatterplot (2)



Scatterplot (1) is the plot of student marks on their last test against their shoe size. The value for r was calculated to be 0.2. Scatterplot (2) is the plot of student marks on their last test against the time spent studying. The value for r was calculated to be 0.8. Describe the relationship between the values of r and the shape of the scatterplots.

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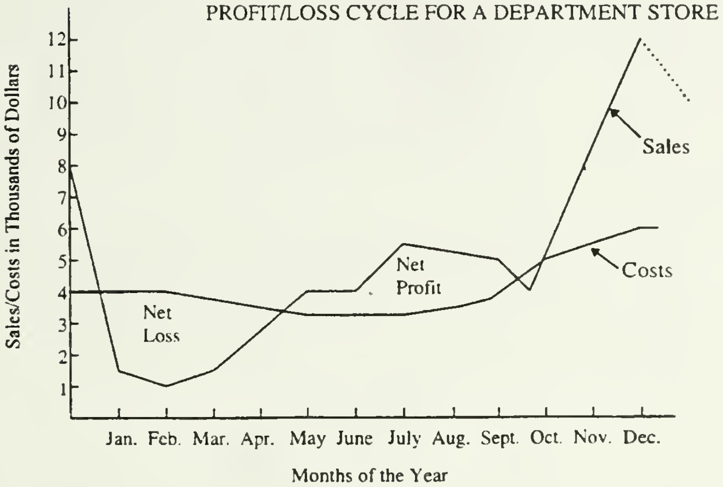
General and Specific Outcomes	Illustrative Examples [Discretionary]
General Outcome Analyze graphs or charts of given situations to derive specific information.	
Specific Outcomes	
A4–1. Extract information from given graphs of discrete or continuous data, using: • time series • glyphs (custom pictorial representations) • continuous data • contour lines. [C, CN, E, PS, R, V]	1.1 Sometimes points representing discrete data are joined, even though specific values for intermediate points may not be available. Give examples where such a practice is acceptable and other examples where it is not. 1.2  A department store may experience "peaks" and "troughs" in its revenue (sales). Christmas season and summer holidays are the two strongest periods. January to April can be the weakest period. If net profits are greater than net losses over the year, the business can stay in operation. a) During periods of net loss, what might the business do for finances? b) Over which of the two curves, Sales or Costs, does the business have the most managerial control? c) Discuss the net profit for May.

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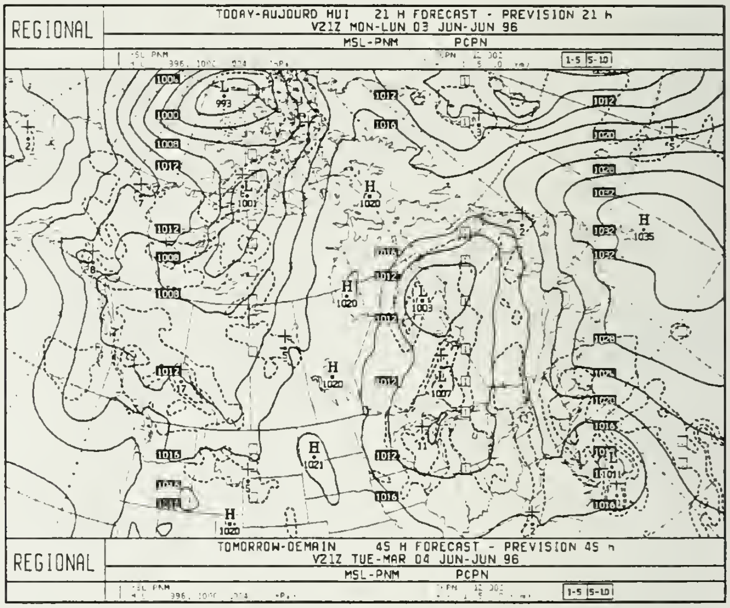
General and Specific Outcomes	Illustrative Examples [Discretionary]
	1.3 The map below shows the atmospheric pressure, measured in hectopascals, forecast at various weather stations for June 3, 1996. A current Environment Canada map can be found on the Internet at: http://www.cmc.doe.ca/cmc/images/charts/125_100.gif  REGIONAL TODAY-AUJOURD HUI 21 H FORECAST - PREVISION 21 h V21Z MON-LUN 03 JUN-JUN 96 MSL-PNM PCPN REGIONAL TOMORROW-DEMAIN 45 H FORECAST - PREVISION 45 h V21Z TUE-MAR 04 JUN-JUN 96 MSL-PNM PCPN From Environment Canada, on line, June 2, 1996, with permission. a) Using a current map, estimate the forecasted atmospheric pressure at your location. b) What is the lowest pressure recorded in Canada for the date on your map? c) What is the highest pressure recorded in Canada for the date on your map? d) Shaded areas show where rain is falling. What connection is there between atmospheric pressure and rainfall?

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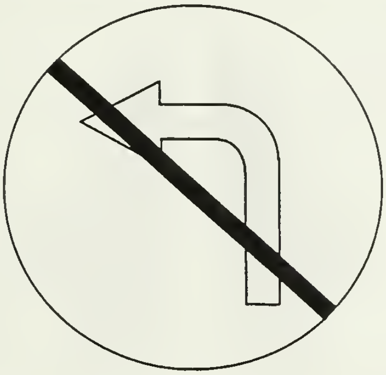
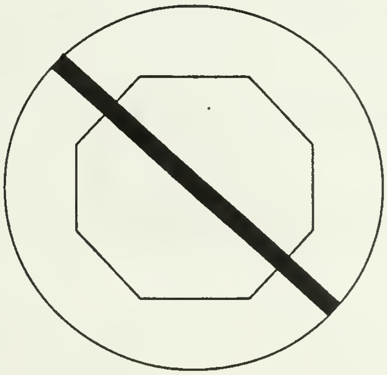
General and Specific Outcomes	**Illustrative Examples [Discretionary]**
	1.4 Pictorial road signs, as used in Canada and most other countries, are examples of glyphs. They use shapes and sizes to convey the type of sign; then levels of symbols are used to convey meaning. Thus, the sign for *no left turn*, shown in the diagram below, is a two-level glyph that has a circular shape, a left turn arrow and a bar through the arrow.  a) What does the circular shape represent? b) What does the bar mean? c) What is the meaning of the sign below, and how is the meaning conveyed?  d) Design a three-level glyph for *no right turn for trucks*. Why is there no such sign in provincial operator manuals?

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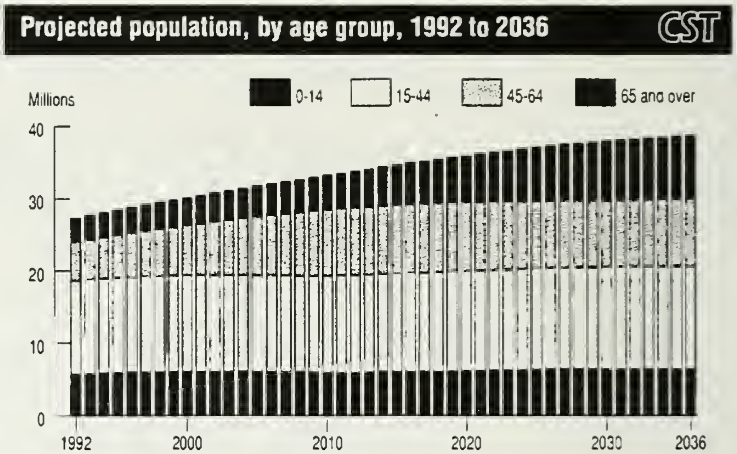
General and Specific Outcomes	Illustrative Examples [Discretionary]
A4–2. Draw and validate inferences, including interpolations and extrapolations, from graphical and tabular data. [CN, E, PS, V]	2.1 The bar graph below shows the projected Canadian population, by age group, for the period from 1992 to 2036.  Source Statistics Canada, Demography Division, unpublished data, projection 3 modified to use T.F.R. of 1.84, annual immigration of 250,000, annual emigration of 86 886. Reproduced by authority of the Minister of Industry, 1998, Statistics Canada, *Canadian Social Trends*, Catalogue 11–008E, Number 29 Summer 1993, p. 6. a) What year is Canada's population expected to reach 30 million? b) Describe the rate of increase of Canada's population, both overall and by age group. c) Estimate the median age of the Canadian population in 1992 and in 2036. d) Estimate when Canada's population will reach 40 million.

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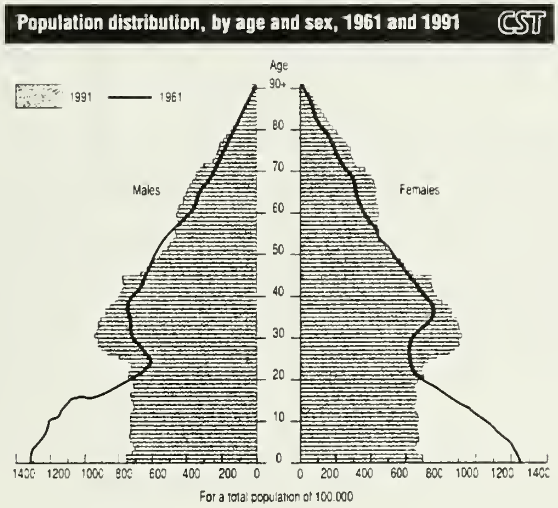
General and Specific Outcomes	Illustrative Examples [Discretionary]

2.2 The population pyramids shown below are for Canada for 1961 and 1991. Separate data are shown for males and females.

Population distribution, by age and sex, 1961 and 1991



Source Statistics Canada, Demography Division

Reproduced by authority of the Minister of Industry, 1998, Statistics Canada, *Canadian Social Trends*, Catalogue 11–008E, Number 29 Summer 1993, p. 6.

a) What is the approximate ratio of male births to female births? Has this ratio changed from 1961 to 1991? Describe any change, and make a hypothesis for the change.
b) The baby boom was a period of time that was characterized by a greater number of births than in the years before or after. What evidence is there for a baby boom, and what were the years of the baby boom?
c) The birth rate was low during the years of the Depression (1931–39) and World War II (1939–45). Where is there evidence for this?
d) The shapes of the population pyramids, especially the 1961 pyramid, show a marked lack of symmetry between the data for males and the data for females. Identify where the lack of symmetry is greatest, and make hypotheses for the lack of symmetry. How could these hypotheses be tested?
e) Sketch a population pyramid for the year 2011, identifying any assumptions made. Use the graph from illustrative example 2.1 as necessary.

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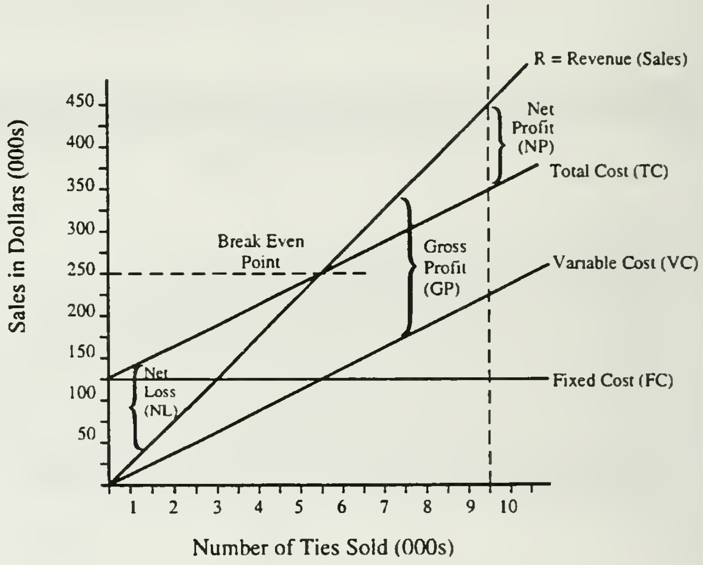
General and Specific Outcomes	**Illustrative Examples [Discretionary]**
	2.3 BREAK EVEN ANALYSIS  A small store in a shopping mall sells neckties for \$50 each. The ties cost the merchant \$25 each. Yearly operating expenses, such as wages, rent, utilities and insurance, are \$125 000. $VC + FC = TC$, $R - VC = GP$, $GP - FC = NP$, $R - TC = NP$ (or NL) If the store sold 100 ties, the sales (R) would not pay for the expenses; therefore, the store would be losing money. At \$250 000 in sales, the store's sales just cover all the cost of the goods sold (VC) and expenses (FC). Therefore, the store just breaks even. If the store sells 9000 ties in a year: a) What is the net profit? b) What is the gross profit? c) What is the fixed cost?

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General and Specific Outcomes	Illustrative Examples [Discretionary]
A4–3. Design different ways of presenting data and analyzing results, by focusing on the truthful display of data and the clarity of presentation. [C, CN, T, V]	3.1 Collect an example from a newspaper or magazine in which a graph has been presented in a potentially deceptive manner. Identify the source from which the graph was taken. Explain briefly the ways in which the graph might have been deceptively presented and then show ways the data might be presented more fairly or in a less distorted fashion. Include the graph with the project, and cite its source. Excerpted and adapted with permission from *Data Analysis and Statistics* (*Curriculum and Evaluation* Addenda Series, Grades 9–12), copyright 1992 by the National Council of Teachers of Mathematics. All rights reserved. 3.2 Using data for 10-year intervals, as provided in Canada's Population table on the following page, starting in 1921 and ending in 1991, design an honest presentation of the data that can be included in different term papers dealing with each of the following topics: a) the increase in Canada's population b) the westward shift of Canada's population c) the population of Saskatchewan d) the dominant position of Ontario and Quebec within Canada. Explain your choice of data selection and data presentation.

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General and Specific Outcomes	Illustrative Examples [Discretionary]

Canada's Population[1] (Thousands)

	Nfld.	PEI	NS	NB	Que.	Ont.	Man.
1921		88.6	523.8	387.9	2,360.5	2,933.7	610.1
1931		88.0	512.8	408.2	2,874.7	3,431.7	700.1
1941		95.0	578.0	457.4	3,331.9	3,787.7	729.7
1951	361.4	98.4	642.6	515.7	4,055.7	4,597.6	776.5
1956	415.1	99.3	694.7	554.6	4,628.4	5,404.9	850.0
1961	457.9	104.6	737.0	597.9	5,259.2	6,236.1	921.7
1966	493.4	108.5	756.0	616.8	5,780.8	6,960.9	963.1
1971	522.1	111.6	789.0	634.6	6,027.8	7,703.1	988.2
1976	557.7	118.2	828.6	677.3	6,234.5	8,264.5	1,021.5
1981	567.7	122.5	847.4	696.4	6,438.2	8,624.7	1,026.2
1986	568.3	126.6	873.2	710.4	6,540.2	9,113.0	1,071.2
1987[2]	568.1	127.3	878.0	712.3	6,592.6	9,265.0	1,079.0
1988[2]	568.8	128.5	881.9	714.3	6,640.8	9,431.1	1,084.1
1989[2]	571.1	129.9	888.3	717.8	6,698.2	9,589.6	1,086.3
1990[2]	572.7	130.7	895.1	722.6	6,768.2	9,749.6	1,089.0
1991[2]	575.7	131.2	901.0	727.6	6,847.4	9,917.3	1,094.4
1992[3]	577.5	130.5	906.3	729.3	6,925.2	10,098.6	1,096.8

	Sask.	Alta.	BC	YT	NWT	Canada
1921	757.5	588.5	524.6	4.1	8.1	8,787.4
1931	921.8	731.6	694.3	4.2	9.3	10,376.7
1941	896.0	796.2	817.8	5.0	12.0	11,506.7
1951	831.7	939.5	1,165.2	9.1	16.0	14,009.4
1956	880.7	1,123.1	1,398.5	12.2	19.3	16,080.8
1961	952.2	1,332.0	1,629.1	14.6	23.0	18,265.3
1966	955.4	1,463.2	1,873.7	14.4	28.7	20,014.9
1971	926.2	1,627.9	2,184.6	18.4	34.8	21,568.3
1976	921.3	1,838.0	2,466.6	21.8	42.6	22,992.6
1981	968.3	2,237.3	2,744.2	23.2	45.7	24,341.7
1986	1,010.2	2,375.1	2,889.0	23.5	52.2	25,353.0
1987[2]	1,015.8	2,377.7	2,925.0	24.5	52.0	25,617.3
1988[2]	1,013.5	2,388.7	2,980.2	25.2	52.2	25,909.2
1989[2]	1,006.7	2,425.9	3,048.3	25.5	52.9	26,240.3
1990[2]	997.1	2,473.1	3,132.5	26.0	53.9	26,610.4
1991[2]	994.2	2,521.6	3,212.1	26.7	55.2	27,004.4
1992[3]	993.2	2,562.7	3,297.6	27.9	56.5	27,402.1

1. As of June 1.
2. Final postcensal estimates.
3. Updated postcensal estimates.

Sources
Employment and Immigration Canada
Statistics Canada

Reproduced by authority of the Minister of Industry, 1998, Statistics Canada, *Canada Year Book 1994*, Catalogue No. 11–402E/1994, p. 112.

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Burrill, Gail et al. *Data Analysis and Statistics Across the Curriculum.* In *Curriculum and Evaluation Standards for School Mathematics: Addenda Series, Grades 9–12.* Reston, VA: The National Council of Teachers of Mathematics, Inc. 1906, copyright 1992. Excerpts from pages 33 and 63 adapted with permission. All rights reserved.

Environment Canada, on line at http://www.cmc.doe.ca/.

Minister of Industry, 1998, Statistics Canada. *Canada Year Book 1994.* Catalogue No. 11–402E/1994, page 112. Reproduced by authority.

________. *Canadian Social Trends.* Catalogue 11–008E, Number 29 Summer 1993, page 6. Reproduced by authority.

Note: Readers wishing further information on data provided through the cooperation of Statistics Canada may obtain copies of related publications by mail from: Publications Sales, Statistics Canada, Ottawa, Ontario, K1A 0T6, by calling 1–613–951–7277 or toll-free 1–800–267–6677. Readers may also facsimile their order by dialing 1–613–951–1584.

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